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Accelerator Division SRF Facilities

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Mini-Review of Fermilab's Accelerator Test Facilities Program

March 17, 2015

Outline

- AD SRF Facility Overview
- Cost Model and Methodology
- Details of each Facility (scope, users, cost, etc.)
 - NML
 - CMTF
 - MDB
 - AO
- Summary

AD SRF Test Facilities



SRF Accelerator Test Facility Complex (NML and CMTF)

Cryomodule Test Facility (CMTF)

Cryomodule Test Stand (CMTS1)

Vacuum Cleanroom

Cryogenic Cold Boxes

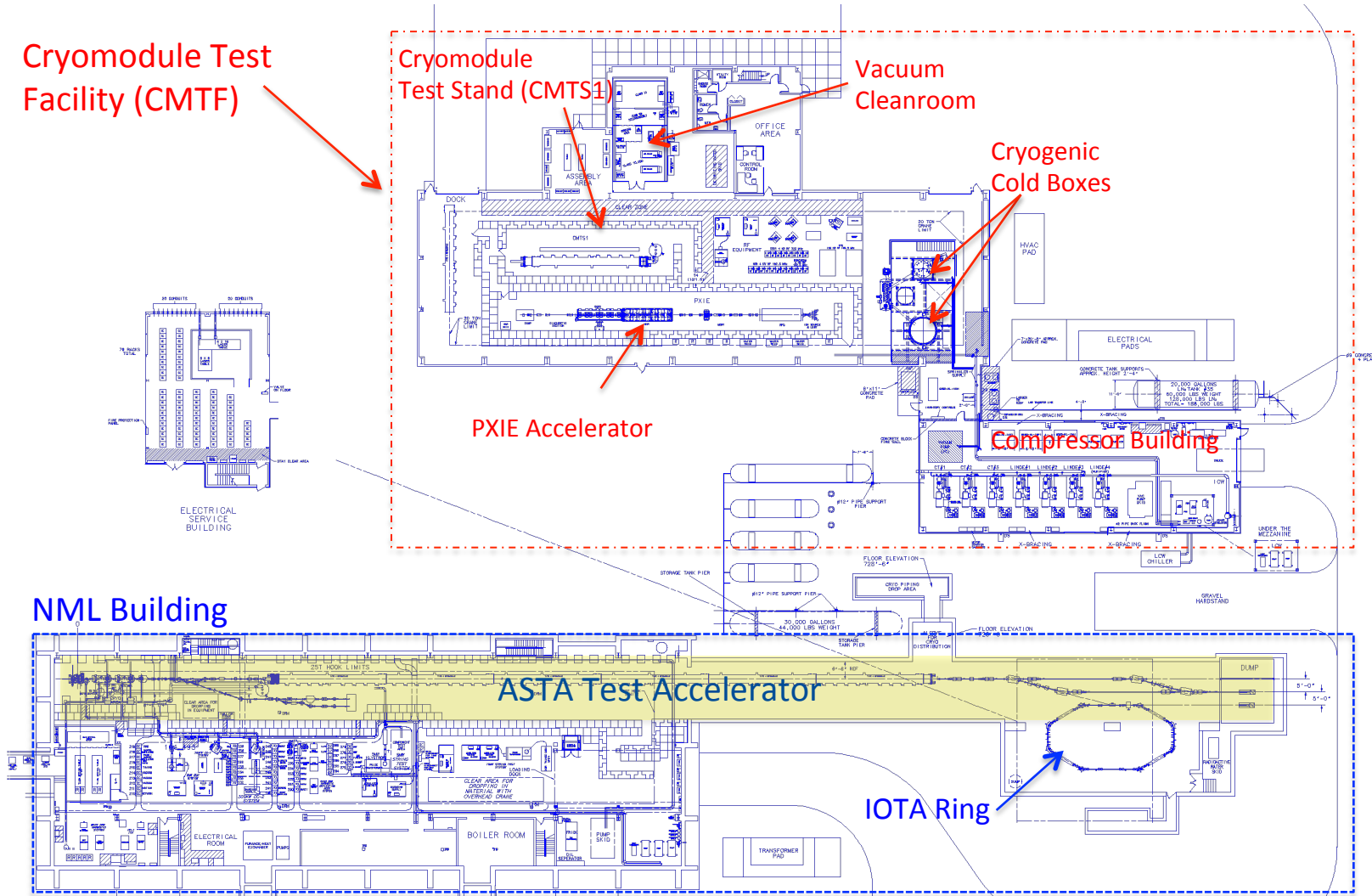
PXIE Accelerator

Compressor Building

NML Building

ASTA Test Accelerator

IOTA Ring



Cost Model

- Each Test Facility has two distinct costs
 - 1) Cost to maintain the building, infrastructure and subsystems in a “ready to operate” state (this talk)
 - Maintenance and upkeep of building
 - Operation and maintenance of utilities (air, water, HVAC, electrical)
 - Support of office space, meeting rooms, etc.
 - Minimal labor and M&S for accelerator system support to keep in an operational state (RF, controls, safety systems, etc.)
 - 2) Cost to operate the Test Accelerator (Elvin’s talk)
 - This may or may not be part of the Test Facilities B&R, depending on the user/customer and purpose of the specific Test Facility
 - Includes M&S needed to operate the accelerator or test stand (cryogenics, laser systems, instrumentation, etc.)
 - Includes labor needed to operate the accelerator or test stand (operators, scientists, RF, controls, technicians, engineers, etc.)

Cost Methodology

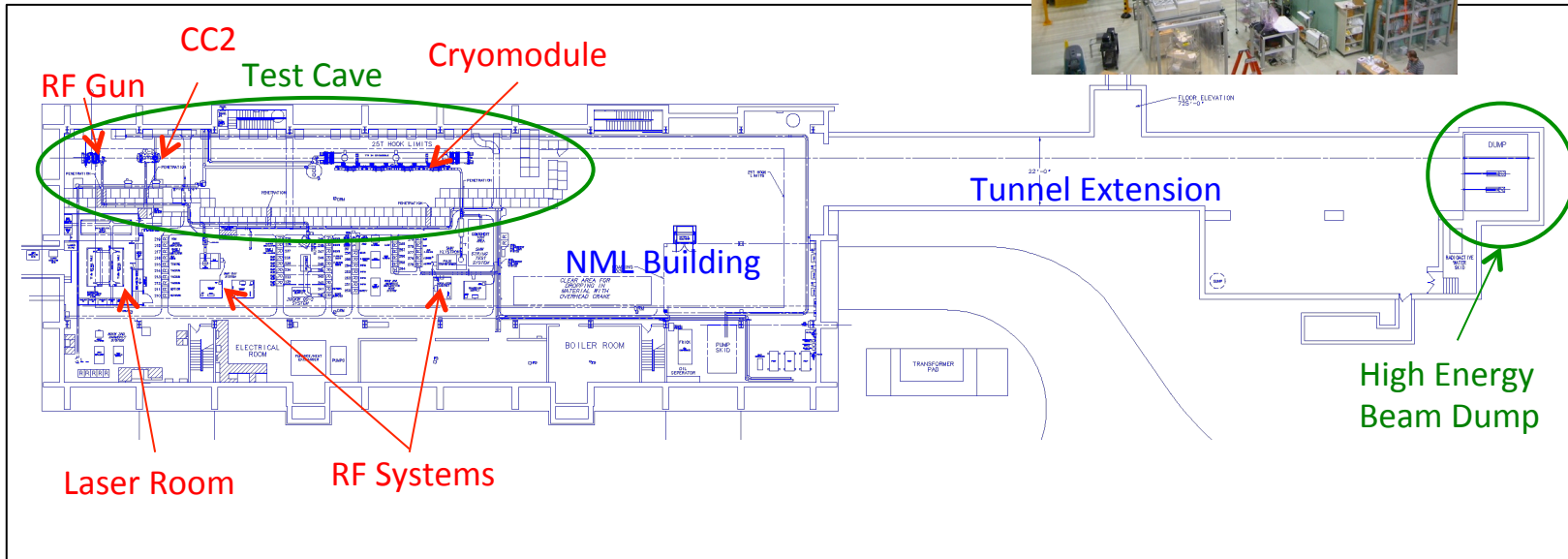
- Cost Estimates are based on:
 - Actual prices/quotes
 - Historical costs
 - Subproject Leaders and Technical Expert estimates
- Estimates are done in direct \$ (for M&S) and FTE's (for labor) and then FY2015 loaded overhead rates are applied
 - FY15 M&S overhead rate = **23.53%**
 - Total labor costs are based on actual FY15 loaded labor rates and projected FY16/17 rates for the type of job categories required (avg. ~ **\$200k/FTE**)

Cost Methodology (cont.)

- A thorough process occurs Labwide, each budget planning cycle (Fiscal Year), to match requests/demands from projects, operations, etc. to actual individuals in each department. This process has already begun for FY16/FY17
- The estimates being presented are the numbers from this process, in addition to the actual FY15 budget numbers

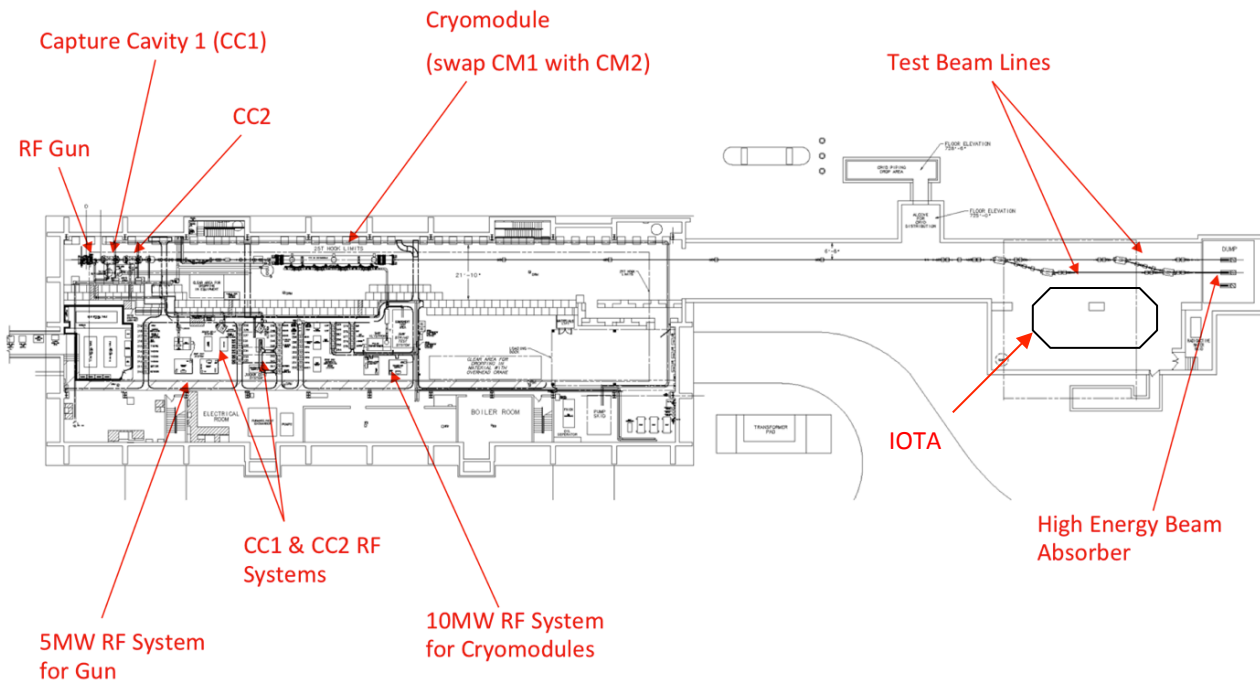
NML Facility

- NML
 - NML is an SRF Accelerator R&D Test Facility under construction that includes an electron accelerator containing multiple SRF cryomodules
 - Current configuration of NML



NML Facility – Customers

- NML Customers/Users
 - IOTA (Integral Optics Test Accelerator)
 - ASTA (Advanced Superconducting Test Accelerator)
 - Construction/installation paid by GARD



ASTA Cave in NML



NML Facility Ops.

- The “NML Facility Ops.” budget includes the following:
 - Labor and M&S to maintain and operate cryogenic, vacuum, water, air, controls, RF and safety systems, as well as general operations of the building

Description	Direct M&S FY14 (\$k)	Direct M&S FY15 (\$k)	Direct M&S FY16 (\$k)	Direct M&S FY17 (\$k)
Cryogenic Operations & Maintenance	0	15	0	0
Aux. Systems Maintenance (water & air)	20	20	25	25
Contract Fluids Engineer	22	10	30	20
T&M (elect., piping, carpentry)	100	0	90	50
Vacuum/Cleanroom equipment	57	50	40	40
Control Room/Office Area	12	17	20	20
Misc. Ops. (tools, stockrm, licenses, machine shop)	56	50	50	50
General System Support (RF, Controls, Safety)	11	20	20	20
Total Direct M&S (\$k)	278	182	275	225
Labor (FTE's)	3.0	3.0	3.3	3.8

Example of Labor Budget Details

- Section of FY16 labor planning spreadsheet by name

Department/Name	Job Category	FY16 Guidance	NML Facility Ops. 20.00.01.84 Test Facilities	CMTF Facility Ops. 20.00.01.85 Test Facilities	MDB Ops. 20.00.01.79 Test Facilities
Mech. Supt. Dept.		Total:	3.30	3.20	2.60
[Redacted]	Mechanical Technical Manager		0.10	0.10	
[Redacted]	Mechanical Design Engineer		0.10		
[Redacted]	Mechanical Design Engineer				
[Redacted]	Mechanical Design Engineer			0.10	
[Redacted]	Mechanical Design Engineer				
[Redacted]	Mechanical Design Engineer		0.10	0.10	
[Redacted]	Contract Engineer				
[Redacted]	Mechanical Design Engineer				
[Redacted]	Mechanical Designer		0.10	0.20	
[Redacted]	Mechanical Designer				
[Redacted]	Mechanical Designer				
[Redacted]	Mechanical Designer				
[Redacted]	Mechanical Technician Supervisor		0.20	0.20	
[Redacted]	Mechanical Assembly Technician			0.10	
[Redacted]	Mechanical Assembly Technician		0.20	0.10	
[Redacted]	Mechanical Assembly Technician		0.10	0.10	
[Redacted]	Mechanical SRF Technician		0.10		
[Redacted]	Mechanical SRF Technician				
[Redacted]	Contract Tech.				
[Redacted]	Mechanical Assembly Technician				0.30
[Redacted]	Mechanical Assembly Technician				
[Redacted]	Mechanical Systems Technician		0.30	0.30	0.20
APC					
[Redacted]	Accelerator Physicist Experimental Scientist				
[Redacted]	Accelerator Physicist Experimental Scientist				
[Redacted]	Accelerator Systems Specialist				
[Redacted]	Interlock Engineer				
[Redacted]	Electronics Design Engineer		0.20	0.20	
[Redacted]	Electrical Technician		0.20	0.20	
[Redacted]	Accelerator Operator				
[Redacted]	Accelerator Operator				

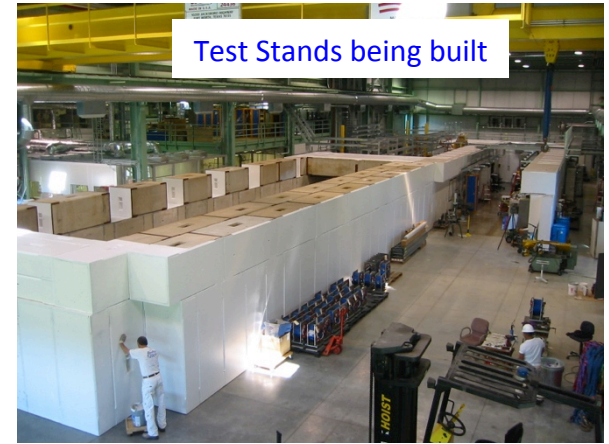
Example of Labor Budget Details (cont.)

- FY16 Test Facilities labor roll-up by department

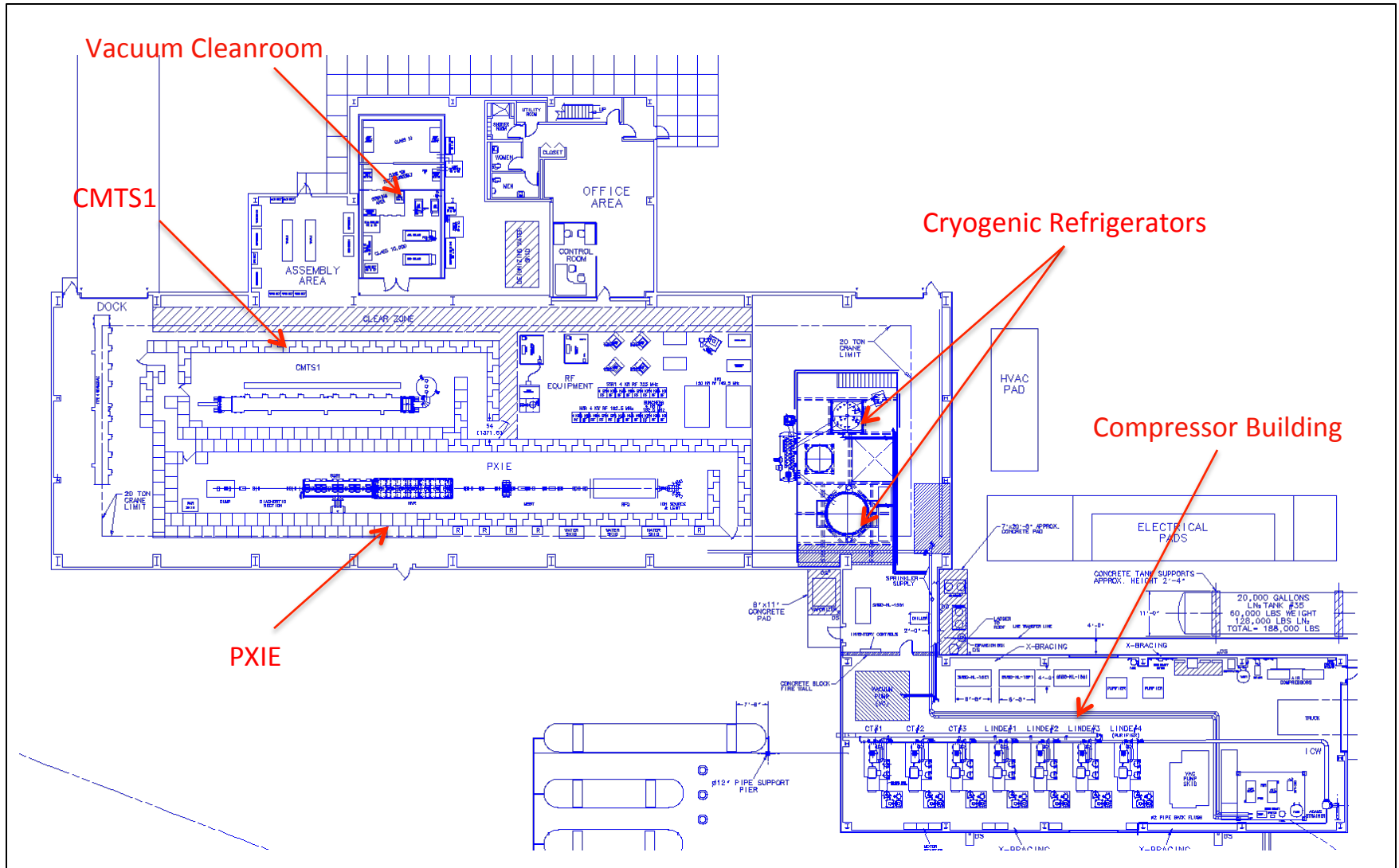
Department/Name	FY16 Guidance	NML Facility Ops. 20.00.01.84 Test Facilities	CMTF Facility Ops. 20.00.01.85 Test Facilities	MDB Ops. 20.00.01.79 Test Facilities
	Task Number			
	Source:			
	Total:	3.30	3.20	2.60
Mech. Supt. Dept. (eng., techs.)		1.30	1.30	0.50
Accel. Physics Center (operators, scientists, laser)		0.40	0.40	
Cryogenic Dept.		0.50	0.50	1.20
PIP-II Dept. (scientists, engineers)				0.40
Instrumentation Dept.		0.20	0.20	
RF Dept.		0.40	0.30	0.40
Elec. Eng. Supt. Dept.		0.10	0.10	
Controls Dept.		0.20	0.20	0.10
PPD (Alignment, T&M Mgt.)		0.20	0.20	

CMTF Facility

- Cryomodule Test Facility (CMTF)
 - CMTF is a new (2012) set of buildings (adjacent to NML) designed to house a helium cryoplant and two cryomodule test stands
 - Customers/Users
 - CMTS1 (test stand for testing LCLS-II Cryomodules)
 - PXIE (PIP-II Front-End Test Accelerator)

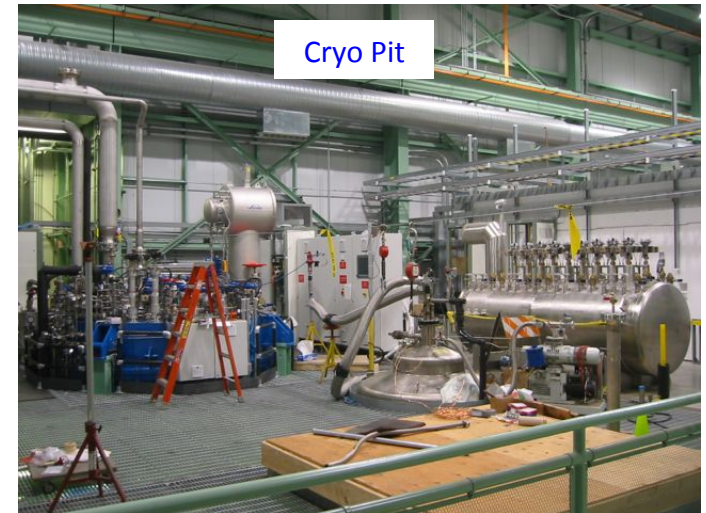


CMTF Building Layout



CMTF Cryoplant

- Helium Cryoplants in CMTF (nominal capacities)
 - New Superfluid Refrigerator (40K, 4.5K, 2K, using cold compressors)
 - ~ 250W @ 1.8K or 500W @ 2K
 - Repurposed SLAC CTI-4000 Refrigerator – (liquefier using turbine expanders)
 - ~ 1500W @ 4.5K



CMTF Facility Ops.

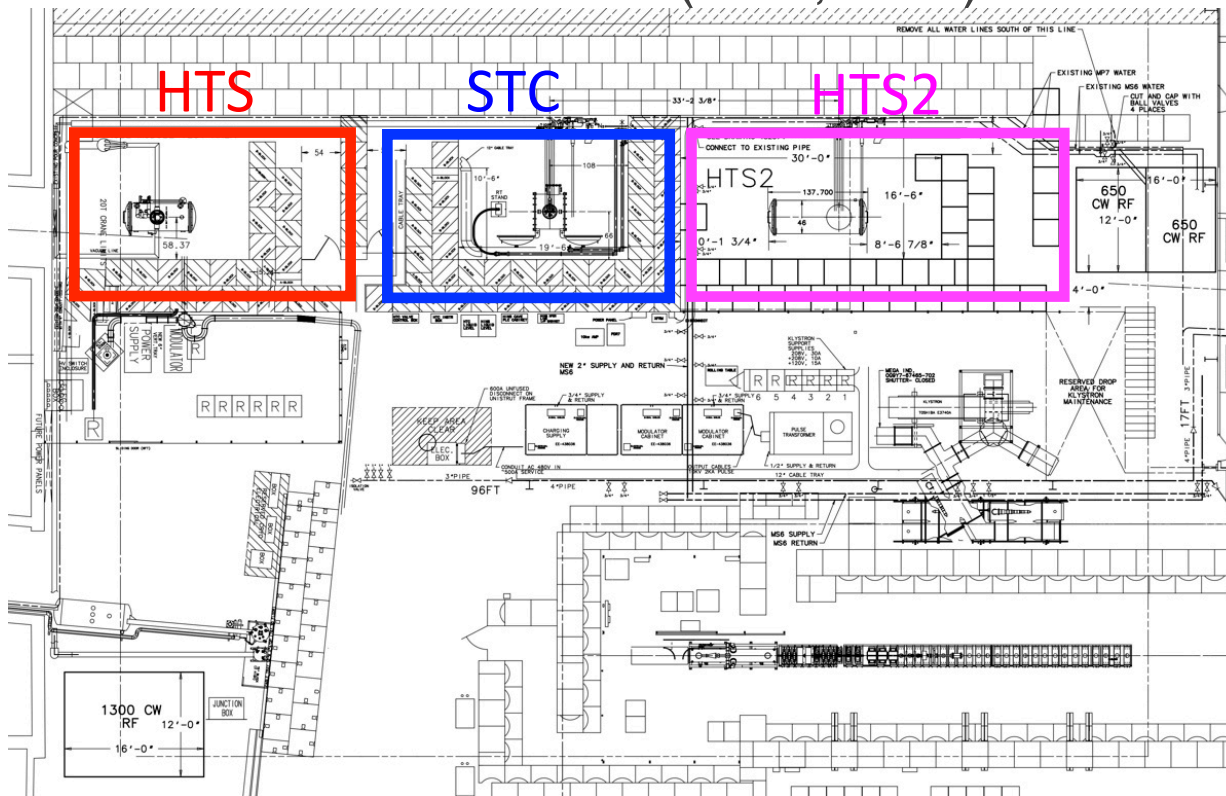
- The “CMTF Facility Ops.” budget includes the following:
 - Labor and M&S to maintain and operate cryogenic, vacuum, water, air, controls, RF and safety systems, as well as general operations of the building

Description	Direct M&S FY14 (\$k)	Direct M&S FY15 (\$k)	Direct M&S FY16 (\$k)	Direct M&S FY17 (\$k)
Cryogenic Operations & Maintenance	79	30	30	30
Aux. Systems Maintenance (water & air)	9	15	30	30
Contract Fluids Engineer	62	40	30	30
T&M (elect., piping, carpentry)	150	120	120	100
Vacuum equipment	0	0	40	40
Control Room/Office Area	5	10	15	15
Misc. Ops. (tools, stockrm, licenses, machine shop)	30	33	50	50
General System Support (RF, Controls, Safety)	0	0	35	35
Total Direct M&S (\$k)	300	248	350	330
Labor (FTE's)	2.0	2.3	3.2	3.4

MDB Facility

- MDB Test Facility

- Includes 3 SRF cavity test stands (HTS, HTS2, and STC). Building is managed by AD, but test stands are operated by TD.
- Users/Customers are PIP-II (HTS, STC) and LCLS-II (HTS2)



MDB Facility Ops.

- The “MDB Facility Ops.” budget includes the following:
 - Labor and M&S to maintain and operate cryogenic, water, air, controls, RF and safety systems, as well as general operations of the building

Description	Direct M&S FY14 (\$k)	Direct M&S FY15 (\$k)	Direct M&S FY16 (\$k)	Direct M&S FY17 (\$k)
Cryogenic Operations & Maintenance	173	60	0	0
Aux. Systems Maintenance (water & air)	4	7	4	4
T&M (elect., piping, carpentry)	50	0	40	0
General System Support (RF, Controls, Safety)	12	10	10	10
Infrastructure for HTS2 Cave (shield blocks)	0	0	200	0
Total Direct M&S (\$k)	239	77	254	14
Labor (FTE's)	2.4	2.4	2.6	3.0

A0/HBESL Facility

- The A0 Facility was the original SRF accelerator test facility at Fermilab. Over the past few years, many of the activities have been moved to NML & CMTF and the remaining will be moved to other facilities in the near future
- There is currently only a very minimal portion of the Fermilab budget used to fund the remaining operations at A0
- Elvin will discuss in greater detail what these important activities are and the related funding

AD Test Facilities Budget Summary

<u>AD Test Facilities Summary</u>	Direct M&S (\$k)	Loaded M&S (23.53% OH)	Direct SWF (FTE)	Loaded SWF (~\$200k/FTE)	FY14 Total (\$k)	FY15 Total (\$k)	FY16 Total (\$k)	FY17 Total (\$k)
<u>Cryogenic Operations</u>								
FY14	\$603	\$745	10.5	\$2,100	\$2,845			
FY15	\$506	\$625	10.6	\$2,120		\$2,745		
FY16	\$524	\$647	16.5	\$3,300			\$3,947	
FY17	\$545	\$673	16.5	\$3,300				\$3,973
<u>SRF Facilities</u>								
NML Facility Operations								
FY14	\$278	\$343	3.0	\$600	\$943			
FY15	\$182	\$225	3.0	\$600		\$825		
FY16	\$275	\$340	3.3	\$660			\$1,000	
FY17	\$225	\$278	3.8	\$760				\$1,038
CMTF Facility Operations								
FY14	\$300	\$371	2.0	\$400	\$771			
FY15	\$248	\$306	2.3	\$460		\$766		
FY16	\$350	\$432	3.2	\$640			\$1,072	
FY17	\$330	\$408	3.4	\$680				\$1,088
MDB Facility Operations								
FY14	\$239	\$295	2.4	\$480	\$775			
FY15	\$77	\$95	2.4	\$482		\$577		
FY16	\$254	\$314	2.6	\$520			\$834	
FY17	\$14	\$17	3.0	\$600				\$617
<u>Beam Test Facilities Operations</u>								
ASTA Accelerator Operations								
FY14	\$289	\$357	3.8	\$760	\$1,117			
FY15	\$214	\$264	2.8	\$560		\$824		
FY16	\$252	\$311	4.1	\$820			\$1,131	
FY17	\$360	\$445	4.5	\$900				\$1,345
AO/HBESL Operations								
FY14	\$27	\$33	0.3	\$50	\$83			
FY15	\$12	\$15	0.2	\$34		\$49		
FY16	\$66	\$82	1.3	\$260			\$342	
FY17	\$0	\$0	0.0	\$0				\$0
PXIE Accelerator Operations								
FY14	\$0	\$0	0.0	\$0	\$0			
FY15	\$0	\$0	0.0	\$0		\$0		
FY16	\$70	\$86	0.5	\$100			\$186	
FY17	\$220	\$272	1.0	\$200				\$472
<u>MTA Operations</u>								
FY14	\$69	\$85	0.0	\$0	\$85			
FY15	\$0	\$0	0.0	\$0		\$0		
FY16	\$175	\$216	2.2	\$440			\$656	
FY17	\$355	\$439	3.4	\$680				\$1,119
Total:					\$6,620	\$5,786	\$9,169	\$9,651

Thank You!